

AMENDMENTS TO THE DRAWINGS:

The attached sheet of drawings includes changes to Figure 3. This sheet, which includes Figures 1-3, replaces the original sheet including Figures 1-3. The modifications to Figure 3 consist exclusively of correction of reference numerals.

REMARKS

This application has been amended so as to place it in condition for allowance at the time of the next Official Action.

The Official Action objects to the drawings for failing to comply with 37 CFR §1.84(p)(4), in light of apparent inconsistencies between the specification and drawing figures. Applicants have provided a replacement sheet of drawings that modifies present Figure 3. The modifications to Figure 3 consist exclusively of correction of reference numerals. The following is the list of original reference numerals and the associated new reference numerals by which they are replaced: 23 by 37; 18 by 22; 24 by 38; 25 by 39; 26 by 40; and 27 by 21.

Applicants have also amended the specification as necessary to reflect these changes. As a result of such amendments to the specification and drawing figure, applicants believe that all inconsistencies have been removed, and reconsideration and withdrawal of this objection are therefore respectfully requested.

The Official Action rejects claims 15-17 under 35 USC §112, second paragraph, as being indefinite. Please note that applicants have amended each of the identified claims so as to eliminate the identified bases for this rejection, as well as to bring such claims into correspondence with the amended form of independent claim 12, from which each of the rejected claims

ultimately depends. Reconsideration and withdrawal of this rejection are therefore respectfully requested.

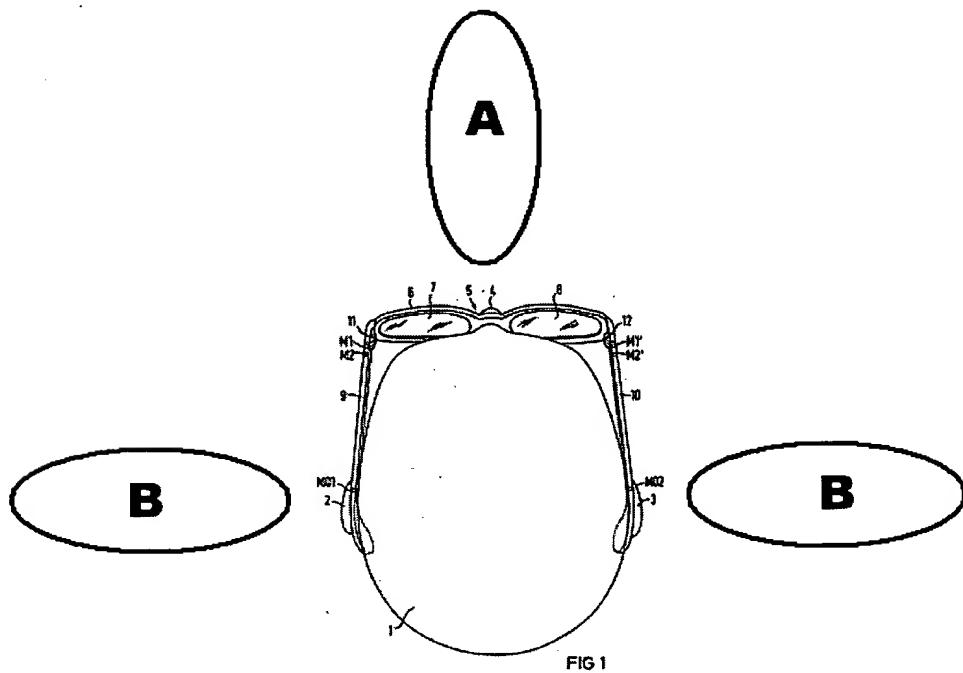
The Official Action rejects claims 12-16 under 35 USC §103(a) as being unpatentable over ZWICKER et al. in view of GORIKE. Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The hearing aid of the present invention provides two distinct output signals, one for the left ear and the other for the right ear. Each of the two output signals is associated with sound essentially originating from a respective one of two different main sensitivity directions.

The inventors discovered, quite unexpectedly, that this beam-forming arrangement improves the understandability of speech in the presence of noise. In addition, the user's perception of spatial awareness, which enables the user to localize a sound source, is obtained from the use of the two output signals, which results from the fact that the two signals differ from one another due to the beam-forming as described above, and as illustrated in Figure 1 of the present application. Moreover, by providing the two separate beams so as to include low, middle, and high portions of the audible frequency range, the user receives the benefits of improved speech understandability and spatial awareness without any loss of sound quality, given the wide frequency range of the received sound. Furthermore, the

present invention and the benefits derived thereby can be obtained using simple omnidirectional microphones.

The primary ZWICKER et al. reference describes a combination of microphones M1, M2, M1', and M2' that necessarily defines a single, forward directed, wide frequency beam with an output signal that is shared by both ears. This is illustrated below as beam A. The addition of microphone signal from M01 and M02 to the signals supplying the left and right ears, respectively, together with low pass filtering provides a separate, frequency dependent, low frequency signal to each ear, illustrated as B below.



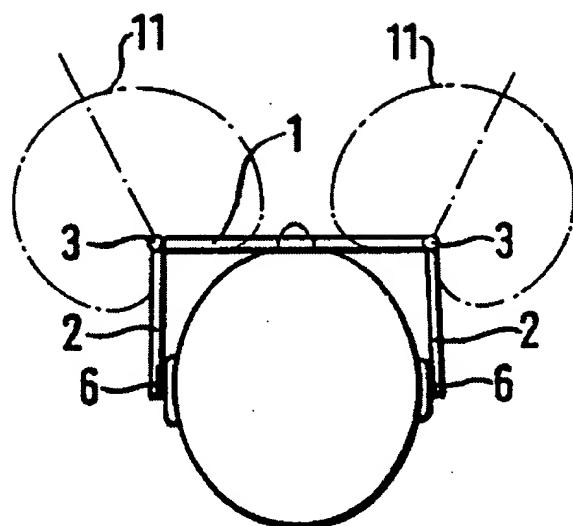
M01 and M02 are used only as locating microphones to provide only a low frequency, general indication of the presence

of a sound. As summarized in column 4 of ZWICKER et al., beginning on line 8:

As discussed above, the two microphones M01 and M02 function as locating microphones. When the eyeglasses are worn by a hearing-impaired person, the microphone M01 lies directly above the left ear of the user, and the microphone M02 lies directly above the right ear of the user. By means of the two locating microphones M01 and M02, the hearing-impaired person can locate a sound source of interest and turn his or her head with the hearing-aid eyeglasses in the direction of this sound source. With the head directed toward the sound source, the directional microphone arrangement consisting of the microphones M1, M2, M1' and M2' can operate fully using the directional reception pattern thereof.

For all of these reasons, the microphones M01 and M02 cannot be considered as part of any array, as they do not participate to any extent in creating the single directional reception pattern described by ZWICKER et al. As ZWICKER et al. note, the directional arrangement derives entirely from M1, M2, M1' and M2'.

The only significance of the GORIKE reference with respect to the rejection is the illustration of Figure 6, reproduced below.



The GORIKE patent states, beginning on line 3 of column 6:

FIGS. 6, 7, 8, 9 and 10 illustrate the directional hearing, corresponding to natural hearing by means of the directional microphones disposed according to the invention in the eyeglass frame. The unilateral directional characteristic 11 of the microphones 3, supported by the sound shielding effect of the head of the user of the invention, makes possible, in the frequency range above 1 kHz, a hearing, which, despite a certain loss of directional information as well as loss of sensitivity, corresponds to the hearing with a perfect ear.

It is worth noting that the GORIKE device utilizes directional microphones to produce a signal that eliminates frequency components below 1 kHz, thereby significantly limiting the responsive bandwidth of microphones 3.

The references, considered independently or collectively, fail to teach structure or function to create two

main sensitivity directions lying at an angle to one another using an array of microphones.

ZWICKER et al. use an array to create only one sensitivity direction with only one array output signal SA, directed straight ahead, using the M1, M2, M1', and M2' microphones. The M01 and M02 microphones do not work as part of an array to provide directional sensitivity. As explicitly stated in the ZWICKER et al. patent, "the two microphones M01 and M02 function as locating microphones," so that when the user turns his head, "the directional microphone arrangement consisting of the microphones M1, M2, M1' and M2' can operate fully using the directional reception pattern thereof."

Moreover, the microphones 3 of the GORIKE device do not work as part of an array. Each is an independent, directional microphone that supplies a signal only to the ear on the same side of the head as that microphone. The signals produced by the microphones remain at all times distinct from one another, and therefore cannot reasonably be construed as an array of microphones. See, e.g., column 5, lines 6-32.

The Official Action takes the position that the device of the primary ZWICKER et al. reference can be modified by the teachings of the secondary GORIKE reference to produce the present invention as claimed. The Official Action summarizes:

Therefore, it would have been obvious to one skilled in the art at the time the invention was made to mount the array of microphones frontally as taught

by Goriike for the hearing aid as an alternate choice, in order to provide a hearing aid having more desirable frontal acoustic response with visual effects, especially when a sound source is located in front of the user.

In this regard, it is worth considering two fundamental tenets of the law defining obviousness. The first is that if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.

MPEP §2143.01 (citing In re Gordon, 733 F.2d 900 (Fed. Cir. 1984)).

The ZWICKER et al. device is specifically designed to provide low frequency, head-shielded, amplified input to the respective ears, thereby providing gross directional information to the user. Based on this information, the user aims the single, central, directional beam toward the sound source.

The proposed modification of the ZWICKER et al. device to replace the single directional beam with the two beams of the GORIKE device would result in the user receiving the low frequency, directional input from the M01 and M02 microphones, based on which the user would turn his head to focus on the sound. However, since the device now has the two lobes 11 of GORIKE, the user must keep his head rotated at an angle oblique to the source of the sound so that such sound source falls within one of the two lobes. By way of example, a user of the ZWICKER

et al.-GORIKE hybrid would stand with his angled away from a person with whom he was speaking. This would clearly render the device "unsatisfactory for its intended purpose."

Alternatively, if the suggested hybrid does away with the direction locating, low frequency microphones M01 and M02, then the user no longer has the benefit of initial direction location, and would be left, according to the teachings of the references, to scan his surroundings, essentially at random, to locate the source of sounds.

A second important tenet of the law of obviousness is that if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. MPEP §2143.01 (citing In re Ratti, 270 F.2d 810, (CCPA 1959).

The analysis offered above with respect to the first tenet is equally applicable to the second. The principle of the system of the device of the primary ZWICKER et al. reference is one based on the principle of generalized, low frequency sound location, followed by turning to focus on the sound source. Replacing the single, central beam with two beams necessarily changes the principle of operation, as the focusing element is now meaningless.

Applicants suggest that not only do the two references fail to teach or suggest the present invention as claimed, they

cannot reasonably be combined to produce any usable device at all. This derives from the fact that ZWICKER et al. and GORIKE take entirely different approaches to hearing assistance.

ZWICKER et al. is based on the assumption that all sound perceived by the user will come through the hearing aid ("The receivers 34 and 35 are generally connected to the ear canals by conduit connections and ear olives (not shown). The receivers may, however, alternatively be directly placed within the ear canals as is standard for in-ear hearing aids." Column 3, line 66 to column 4, line 2). In complete contrast, GORIKE assumes that the ear canal is left completely unblocked to allow for "natural hearing" ("In the position of use, the transducer is applied gently against only parts of the auricle, possibly also with the interposition of a foam member, which must be acoustically fully transparent. This provides access for the natural sound from the users surrounding to the auditory meatus." Abstract).

In terms of localization of the sound source, ZWICKER et al. teach the use of the omnidirectional microphones M01 and M02 ("two locating microphones M01 and M02 (for example Knowles omni-directional microphones) are also arranged in the respective eyeglasses bows 9 and 10." Column 3, lines 23-26). GORIKE teaches that it is through the use of "natural hearing" that the user's natural directional abilities are used. ("directive information comprises interaural time and intensity differences

and of the pinna transfer function" and "in the spirit of the invention also the natural, direct and unamplified sound from the users surrounding is to have free access to the ear without disturbing the pinna transfer functions." Column 4, lines 56-59 and column 5, lines 29-32).

ZWICKER et al. teach the use of a single, wide frequency beam, discussed above, while GORIKE teaches the two high frequency beams 11, also discussed above.

ZWICKER et al. use two low frequency omnidirectional microphones. GORIKE teaches the use of no omnidirectional microphones, but instead two directional microphones in conjunction with the user's unblocked ears.

ZWICKER et al. use two transducers that block the ears (see, e.g. column 3, line 66 to column 4, line 2, also discussed above), while the GORIKE device is fundamentally based on the notion of allowing all natural sound to reach the user's ear in an unrestricted manner.

The ZWICKER et al. device relies on omnidirectional microphones, while the GORIKE device specifically calls for directional microphones ("the microphone 3 is a directional element" Column 5, lines 6-7).

Finally, the ZWICKER et al. device is designed for use potentially by anyone with hearing impairment. The GORIKE device, on the other hand, is expressly meant for "a very large group of mostly older persons whose hearing ability is quite

sufficient for everyday life" and who, with the GORIKE device "hears the low and medium frequencies in the natural way, without amplification, and hears the highest frequencies amplified...." Column 1, lines 56-59, and column 2, lines 61-63.

For all of the reasons, the teachings of the ZWICKER et al. and GORIKE patents are fundamentally at odds with one another, and cannot reasonably be combined to with any reasonable expectation of success. Such expectation must underlie any proper obviousness rejection.

In addition to the above points, which apply to all claims now in the application, a number of claims now recite that the microphone arrays of the present invention are wide band devices. New claims 45 and 58 recite that the array output signals include low, mid, and high frequency components, as described on pages 12-13 of the substitute specification. New claims 27 and 38 recite that the signal summation is performed in a frequency-independent manner, as described on page 7 of the substitute specification.

In stark contrast, ZWICKER et al. utilize one wide band directional beam summed with two low frequency signals. GORIKE uses two high frequency directional microphones in combination with two open ears. Neither reference, nor the combination of the two, teaches two wide band directional beams lying at an angle to one another. ZWICKER et al. require a single directed

beam for focused hearing. GORIKE require two high frequency beams so as not to disturb the pinna transfer function.

In light of the amendments described above and the arguments offered in support thereof, applicants believe that the present application is in condition for allowance, and an early indication of the same is respectfully requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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APPENDIX:

The Appendix includes the following item:

- a Replacement Sheet for Figure 3 of the drawings